

## MM 9: Liquid and amorphous materials III

Time: Monday 14:45–15:45

Location: H4

MM 9.1 Mon 14:45 H4

**Liquid phase demixing and growth in Cu-based alloys** — ●MATTHIAS KOLBE<sup>1</sup>, JIANRONG GAO<sup>2</sup>, JIUZHOU ZHAO<sup>3</sup>, LORENZ RATKE<sup>1</sup>, and DIETER HERLACH<sup>1</sup> — <sup>1</sup>DLR, Institut für Materialphysik im Weltraum, Linder Höhe, 51170 Köln — <sup>2</sup>Key Lab of Electromagnetic Processing of Materials, North Eastern University, Shenyang 110004, China — <sup>3</sup>Institute of Metal Research, CAS, Shenyang 110016, China

Cu-based alloys as Cu-Cr, Cu-Co, Cu-Nb and Cu-Fe exhibit a flat liquidus in the binary phase diagram. This property is often associated to metastable phase separation in the region of the undercooled melt: When the metastable miscibility gap is entered, the homogeneous alloy separates into a Cu-rich and a Cu-poor liquid. The undercooled melt solidifies rapidly and the metastable liquids are frozen in. Microstructure analysis of the solidified material allows the determination of properties of the metastable liquids. We studied phase separation and phase growth of the metastable Co-rich L1 phase in Co-84at%Cu by electromagnetic levitation (EML) and drop tube experiments. In addition, samples have been processed and solidified in the TEMPUS facility during parabolic flights under low gravity conditions. Compared to processing in EML on ground, the fluid flow is reduced in TEMPUS by an order of magnitude. The solidified microstructures show the influence of cooling rate and of the different convection levels in the liquid on phase growth. The results are discussed within current models of liquid phase growth.

MM 9.2 Mon 15:00 H4

**Negative entropy of mixing in computer simulated bulk glass forming Al<sub>x</sub>Ni<sub>1-x</sub>Zr<sub>60</sub> melts** — MOHAMMED GUERDANE and ●HELMAR TEICHLER — Inst. f. Materials Physics, University of Göttingen, D-37077 Göttingen

For multi-component random systems, the ideal solution model predicts positive entropy of mixing, reflecting the increase of configuration space by exchange of chemically different particles. Glass forming melts are usually far from being random. Regarding this, Al<sub>x</sub>Ni<sub>1-x</sub>Zr<sub>60</sub> is known to have marked short- and intermediate-range order. The former is characterized by icosahedral neighbour cages around Al and by trigonal-prismatic ones around Ni-atoms, the latter by chain arrangements of Al- and of Ni-cages (M. Guerdane and H. Teichler, PRE 65, 014203 (2001)). Here the question arises whether in Al<sub>x</sub>Ni<sub>1-x</sub>Zr<sub>60</sub> melts the entropy of mixing is positive, due to a gain in configuration space by particle exchange, or negative, due to a decreased density of low-energy states in the complex liquid at mid-concentrations. Concerning this, we report molecular dynamics results for Al<sub>x</sub>Ni<sub>1-x</sub>Zr<sub>60</sub> melts based on the adiabatic switching approach. They show strong negative entropy of mixing along the quasi-binary line, i.e., predominance of enthalpic over entropic effects in this bulk glass forming liquid. (Supported by DFG SPP 1120 \*Phase Transformations in Multi-Component Melts\*.)

MM 9.3 Mon 15:15 H4

**Primary crystallization reaction in Al-Y-Fe glasses containing**

**low melting point nanoparticles** — ●NANCY BOUCHARAT<sup>1</sup>, HARALD RÖSNER<sup>2</sup>, and GERHARD WILDE<sup>1</sup> — <sup>1</sup>Institut für Materialphysik, Universität Münster, Wilhelm-Klemm-Strasse 10, 48149 Münster, Germany — <sup>2</sup>Institut für Nanotechnologie, Forschungszentrum Karlsruhe, P.O.B. 3640, 76021 Karlsruhe, Germany

Many rapidly quenched Al-rich alloys partially devitrify via a primary crystallization reaction, which results in the development of a high number density of homogeneously dispersed Al-nanocrystals. Although several experimental results are consistent with the formation of nucleation sites during rapid quenching via homophase catalysis, the nature and the origin of the nucleation sites is not yet completely resolved. To assess the role of the as-quenched state in the nanocrystallization process, 1at.% Pb or 1at.% In, respectively were substituted for Al in an Al-Y-Fe glass prior to rapid quenching. The microstructure of the respective products consists of a homogeneous dispersion of nanocrystalline Pb particles or In-enriched regions within an amorphous Al-Y-Fe matrix. In both cases, the primary crystallization is strongly shifted to lower temperatures compared to the reaction in the inclusion-free sample. While likely mechanisms have been proposed to explain the catalytic effect of Pb inclusions on the nanocrystallization process, the analyses on the In-containing sample give new evidence that the inclusions generate a modification of the local structural arrangement of the amorphous matrix promoting the retention of quenched-in nuclei during the quenching process.

MM 9.4 Mon 15:30 H4

**Microstructure and properties of glassy NdCoAl alloys with Ga and Nb additions** — ●MIHAI STOICA<sup>1</sup>, MIHAELA BUSCHBECK<sup>2</sup>, ANNETT GEBERT<sup>2</sup>, LUDWIG SCHULTZ<sup>2</sup>, ALBRECHT WIEDENMANN<sup>3</sup>, OLIVIER PERROUD<sup>3</sup>, SHANKAR WENKATARAMAN<sup>1</sup>, SIMON PAULY<sup>1</sup>, and JÜRGEN ECKERT<sup>1</sup> — <sup>1</sup>IFW Dresden, Institute for Complex Materials, P.O. Box 270016, D-01171 Dresden, Germany — <sup>2</sup>IFW Dresden, Institute for Metallic Materials, P.O. Box 270016, D-01171 Dresden, Germany — <sup>3</sup>Hahn-Meitner Institute Berlin, Glienickestr. 100, D-14109 Berlin, Germany

The glass forming ability and structure upon fast cooling were investigated for Nd<sub>60</sub>Co<sub>30</sub>Al<sub>10</sub> with Ga and Nb additions. The investigated alloys contained 1, 3 and 5 at. % of Ga or Nb. From every composition different samples were produced. The melt spinning apparatus was used to make glassy ribbons 4 mm wide and 0.03 mm thick and by copper mould casting rods with diameters of 1 and 2 mm were cast. The structure of the samples was investigated by means of X-ray diffraction and electronic microscopy and the thermal stability by differential scanning calorimetry (DSC). In order to rule out the effect of composition and cooling conditions, the microstructure and thermal behaviour of master alloys with and without Ga and Nb additions were also checked. The paper will discuss the microstructure formation for different samples, as a function of two parameters: the composition and the cooling rate. The work was supported by the German Science Foundation (DFG) via the DFG priority program \*Phasenumwandlungen in mehrkomponentigen Schmelzen\*.